CHEMISTRY

BOOKS - MTG WBJEE CHEMISTRY (HINGLISH)

CHEMICAL EQUILIBRIA

Wb Jee Workout Category 1 Single Option Correct Type

1. In what manner will increase of pressure affect the following equation?

$$C_{(s)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + H_{2(g)}$$

A. Shift in the forward direction

B. Shift in the reverse direction

C. Increase in the yield of hydrogen

D. No effect

Answer: B

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2. For a chemical reaction $2A + B \Leftrightarrow C$, the thermodynamic equilibrium constant K_p is

A. in atm^{-2}

B. in atm^{-3}

C. in atm^{-1}

D. dimensionless

Answer: A

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3. k_1 and k_2 are the velocity constants of forward and backward reactions. The equilibrium constant K of the reaction is

A. $k_1 \times k_2$

B. $k_1 - k_2$

C. k_1 / k_2

D. $\frac{k_1 + k_2}{k_1 - k_2}$

Answer: C

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4. The following equilibrium are given

$N_2 + 3H_2 \Leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \Leftrightarrow 2NO, K_2$

$H_2 + \frac{1}{2}O_2 \Leftrightarrow H_2O, K_3$

The equilibrium constant of the reaction

$2NH_3 + \frac{5}{2}O_2 \Leftrightarrow 2NO + 3H_2O$ in terms of K_1, K_2 and K_3 is

A. $K_1K_2K_3$

B. K_1K_2 / K_3

C. $K_1K_3^2 / K_2$

D. $K_2K_3^3 / K_1$

Answer: D

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5. The reaction $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$ is endothermic.

The forward reaction is

A. favoured by decrease in temperature

B. favoured by increase in pressure

C. unchanged on changing pressure

D. in equilibrium point shifts by adding catalyst

Answer: C

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6. An equilibrium mixture for the reaction $2H_2S_{(g)} \Leftrightarrow 2H_{2(g)} + S_{2(g)}$ had one mole of hydrogen sulphide, 0.2 mole of H_2 and 0.8 mole of S_2 in a 2 litre vessel. The value of K_c in mole litre^{-1} is

A. 0.004

B. 0.016

C. 0.080

D. 0.032

Answer: B

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7. Which of the following oxides of nitrogen will be the most stable one?

A.

$$2NO_{2(g)} \Leftrightarrow N_{2(g)} + 2O_{2(g)}, K = 6.7 \times 10^{16} molL^{-1}$$

B. $2NO_{(g)} \Leftrightarrow N_{2(g)} + O_{2(g)}, K = 2.2 \times 10^{30} molL^{-1}$

C.

$$2N_2O_{5(g)} \Leftrightarrow 2N_{2(g)} + 5O_{2(g)}, K = 1.2 \times 10^{24} molL^{-1}$$

D.

$$2N_2O_{(g)} \Leftrightarrow 2N_{2(g)} + O_{2(g)}, K = 3.5 \times 10^{33} molL^{-1}$$

Answer: A

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8. The equilibrium of the given reaction

$$SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$$

in attained at $25^\circ C$ in a closed container and an inert gas, helium is introduced. Which of the following statement is correct?

A. More chlorine is formed

B. Concentration of SO_2 is reduced

C. More SO_2Cl_2 is formed

D. Concentration of SO_2Cl_2, SO_2 and Cl_2 do not change

Answer: D

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9. A catalyst is a substance which

A. increases the equilibrium constant of the reaction

B. increases equilibrium concentration of products

C. does not alter the reaction mechanism

D. changes the activation energy of the reaction

Answer: D

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10. The equilibrium constant (K) of a reaction may be written as

A. $K = e^{-\Delta G / RT}$

B. $K = e^{-\Delta G^\circ / RT}$

C. $K = e^{-\Delta H / RT}$

D. $K = e^{-\Delta H^\circ / RT}$

Answer: B

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11. For the reaction: $CO_{(g)} + Cl_{2(g)} \Leftrightarrow COCl_{2(g)}$, K_p / K_c equal to

A. $1 / RT$

B. RT

C. $\sqrt{RT}$

D. 1.0

Answer: A

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12. Of the following which change will shift the reaction towards the product?

$I_{2(g)} \Leftrightarrow 2I_{(g)}, \Delta H_r^{\circ}(298K) = +150kJ$

A. Increase in concentration of I

B. Decrease in concentration o I_2

C. Increase in temperature

D. Increase in total pressure

Answer: C

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13. In the reaction $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$, the equilibrium concentrations of PCl_5 and PCl_3 are 0.4 and 0.2 mole/litre respectively. If the value of K_c is 0.5, what is the concentration of Cl_2 in moles/litre?

A. 2.0

B. 1.5

C. 1.0

D. 0.5

Answer: C

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14. Calculate K_c for the reversible process given below, if $K_p = 167$ and $T = 800^\circ C$.

$CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$

A. 1.95

B. 1.85

C. 1.89

D. 1.60

Answer: C

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15. The reaction quotient (Q) for the reaction

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

is given by $Q = \frac{[NH_3]^2}{[N_2][H_2]^3}$

The reaction will proceed from right to left if

A. $Q = K_c$

B. $Q < K_c$

C. $Q > K_c$

D. $Q = 0$

Answer: C

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16. A quantity of PCl_5 was heated in a 10 dm^3 vessel at $250^\circ C$:

$PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

At equilibrium, the vessel contains 0.1 mole of PCl_5 and 0.2 mole of Cl_2. The equilibrium constant of the reaction is

A. 0.04

B. 0.025

C. 0.02

D. 0.05

Answer: A

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17. 5 moles of SO_2 and 5 moles of O_2 are allowed to react to form SO_3 in a closed vessel. At the equilibrium stage,

$60\,\%\,SO_2$ is used up. The total number of moles of SO_2, O_2 and SO_3 in the vessel now is

A. 3.9

B. 10.5

C. 8.5

D. 10.0

Answer: C

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18. For the reaction:

$2H_{2(g)} + O_{2(g)} \Leftrightarrow 2H_2O_{(g)}$

Which of the following fact holds good?

A. $K_p = K_c$

B. $K_p > K_c$

C. $K_p < K_c$

D. K_p and K_c cannot be correlated

Answer: C

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19. If the equilibrium constants of the following equilibria

$SO_2 + \frac{1}{2}O_2 \Leftrightarrow SO_3$ and $2SO_3 \Leftrightarrow 2SO_2 + O_2$

are given by K_1 and K_2 respectively, which of the following relation is correct?

A. $K_2 = \left(\frac{1}{K_1}\right)^2$

B. $K_1 = \left(\frac{1}{K_2}\right)^3$

C. $K_2 = \left(\frac{1}{K_1}\right)$

D. $K_2 = (K_1)^2$

Answer: A

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20. Calculate K_p for the equilibrium,

$NH_4HS_{(s)} \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$

if the total pressure inside the reaction vessel is 1.12 atm at $105^\circ C$.

A. 0.56

B. 1.25

C. 0.31

D. 0.63

Answer: C

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21. In a reversible chemical reaction at equilibrium, if the concentration of any one of the reactants is doubled, then the equilibrium constant will

A. also be doubled

B. be halved

C. remains the same

D. becomes one-fourth

Answer: C

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22. For the reaction, $P_{(g)} + 3Q_{(g)} \Leftrightarrow 4R_{(g)}$

Initial concentration of P is equal to that of Q. The equilibrium concentration of P and R are equal. K_c is equal to

A. 0.08

B. 0.8

C. 8

D. $\frac{1}{8}$

Answer: C

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23. 1 mole of N_2 and 2 moles of H_2 are allowed to react in a $1dm^3$ vessel. At equilibrium, 0.8 mole of NH_3 is formed. The concentration of H_2 in the vessel is

A. 0.6 mole

B. 0.8 mole

C. 0.2 mole

D. 0.4 mole

Answer: B

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24. In which of the following equilibrium, change in the volume of the system does not alter the number of moles?

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

D. $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$

Answer: A

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25. If equilibrium constant of reaction, $N_2 + 3H_2 \Leftrightarrow 2NH_3$ is K, then K' for reaction, $2N_2 + 6H_2 \Leftrightarrow 4NH_3$ is

A. K^2

B. $\sqrt{K}$

C. $1/\sqrt{K}$

D. $1/K^2$

Answer: A

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26. One mole of SO_3 was placed in a vessel of 1 litre capacity at a certain temperature when the following equilibrium was established.

$2SO_3 \Leftrightarrow 2SO_2 + O_2$

At equilibrium, 0.6 moles of SO_2 were formed. The equilibrium constant of the reaction will be

A. 0.36

B. 0.45

C. 0.54

D. 0.675

Answer: D

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27. 2 mol of N_2 is mixed with 6 mol of H_2 in a closed vessel of one litre capacity. If 50% of N_2 is converted into NH_3 at equilibrium, the value of K_c for the reaction

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$ is

A. $4/27$

B. $27/4$

C. $1/27$

D. 27

Answer: A

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28. Ammonium carbamate when heated to $200^\circ C$ gives a mixture of NH_3 and CO_2 vapours with a density of 16.0. What is the degree of dissociation of ammonium carbamate? (Given vapour density of ammonium carbamate is 48)

A. $3/2$

B. $1/2$

C. 2

D. 1

Answer: D

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29. Consider the following equilibrium in a closed container:

$N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$

At a fixed temperature, the volume of the reaction container is halved. For this change, which of the following statements, holds true regarding the equilibrium constant (K_p) and degree of dissociation (α)?

A. Neither K_p nor α changes

B. Both K_p and α change

C. K_p changes but α not change

D. K_p does not change, but α changes

Answer: D

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30. The rate of forward reaction is two times that of the reverse reaction at a given temperature and identical concentration. $K_{\text{equilibrium}}$ is

A. 0.5

B. 1.5

C. 2.5

D. 2.0

Answer: D

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Wb Jee Workout Category 2 Single Option Correct Type

1. The decomposition of N_2O_4 to NO_2 is carried out at $280^\circ C$ in chloroform. When equilibrium is reached, 0.2 mol of N_2O_4 and 2×10^{-3} mol of NO_2 are present in 2 litre solution. The equilibrium constant for the reaction, $N_2O_4 \Leftrightarrow 2NO_2$ is

A. 1×10^{-3}

B. 2×10^{-3}

C. 1×10^{-5}

D. 2×10^{-5}

Answer: C

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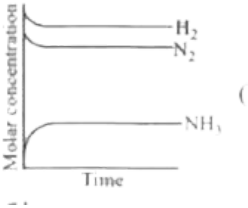
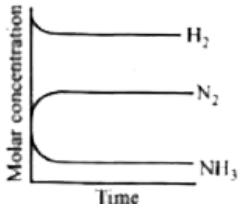
2. For the synthesis of ammonia by the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3$ in the Haber process, the attainment of equilibrium is correctly predicted by the curve

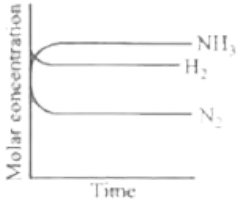
A.



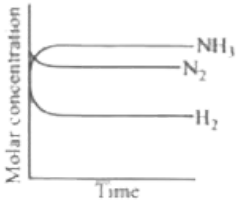
B.



C.



D.



Answer: A

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3. If 0.2 mol of $H_{2(g)}$ and 2.0 mol of $S_{(s)}$ are mixed in a $1dm^3$ vessel at $90^\circ C$, the partial pressure of $H_2S_{(g)}$

formed according to the reaction

$H_{2(g)} + S_{(s)} \Leftrightarrow H_2S, K_p = 6.8 \times 10^{-2}$ would be

A. 0.19 atm

B. 0.38 atm

C. 0.6 atm

D. 0.072 atm

Answer: B

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4. Formaldehyde polymerizes to form glucose according to the reaction

$6HCHO \Leftrightarrow C_6H_{12}O_6$

The theoretically computed equilibrium constant for this reaction is found to be 6×10^{22}. If 1 M solution of glucose dissociates according to the above equilibrium, the concentration of formaldehyde in the solution will be

A. $1.6 \times 10^{-2} M$

B. $1.6 \times 10^{-4} M$

C. $1.6 \times 10^{-6} M$

D. $1.6 \times 10^{-8} M$

Answer: B

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5. If $Ag^{+} + 2NH_3 \Leftrightarrow \left[Ag(NH_3)_2\right]^{+}, K_1 = 1.7 \times 10^7$

$Ag^{+} + Cl^{-} \Leftrightarrow AgCl, K_2 = 5.4 \times 10^9$

Then for $AgCl + 2NH_3 \Leftrightarrow \left[Ag(NH_3)_2\right]^{+} + Cl^{-}$ equilibrium constant will be

A. 0.31×10^{-2}

B. 3.2×102

C. 9.18×1016

D. 1.00×10^{-17}

Answer: A

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6. 56 g of nitrogen and 8 g of hydrogen gas are heated in a cloed vessel. At equilibrium, 34 g of ammonia are present. The equilibrium number of moles of nitrogen, hydrogen and ammonia are respectively

A. 1, 2, 2

B. 2, 2, 1

C. 1, 1, 2

D. 2, 1, 2

Answer: C

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7. In the given reaction

$2X_{(g)} + Y_{(g)} \Leftrightarrow 2Z_{(g)} + 80kcal,$

which combination of pressure and temperature will give the highest yield of Z at equilibrium?

A. 1000 atm and $200^{\circ}C$

B. 500 atm and $500^{\circ}C$

C. 1000 atm and $100^{\circ}C$

D. 500 atm and $100^{\circ}C$

Answer: C

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8. For the following three reaction (i), (ii) and (iii), equilibrium constants are given

(i) $CO_{(g)} + H_2O_{(g)} \Leftrightarrow CO_{2(g)} + H_{2(g)}, K_1$

(ii) $CH_{4(g)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + 3H_{2(g)}, K_2$

(iii) $CH_{4(g)} + 2H_2O_{(g)} \Leftrightarrow CO_{2(g)} + 4H_{2(g)}, K_3$

Which of the following relations is correct?

A. $K_3K_2^3 = K_1^2$

B. $K_1\sqrt{K_2} = K_3$

C. $K_2K_3 = K_1$

D. $K_3 = K_1K_2$

Answer: D

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9. Select the reaction for which the equilibrium constant is written as

$[MX_3]^2 = K[MX_2]^2[X_2]$

A. $MX_3 \Leftrightarrow MX_2 + 1/2X_2$

B. $2MX_3 \Leftrightarrow 2MX_2 + X_2$

C. $2MX_2 + X_2 \Leftrightarrow 2MX_3$

D. $MX_2 + 1/2X_2 \Leftrightarrow MX_3$

Answer: C

View Text Solution

10. For the reaction, $SO_{2(g)} + \frac{1}{2}O_{2(g)} \Leftrightarrow SO_{3(g)}$ if we write $K_p = K_c(RT)^x$, then x becomes

A. -1

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. 1

Answer: B

View Text Solution

11. For the reversible reaction

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

At $500^{\circ}C$, the value of K_p is 1.44×10^{-5} when partial pressure is measured in atmospheres. The corresponding value of K_c with concentration in mole litre^{-1}, is

A. $1.44 \times 10^{-5} / (0.082 \times 500)^{-2}$

B. $1.44 \times 10^{-5} / (8.314 \times 773)^{-2}$

C. $1.44 \times 10^{-5} / (0.082 \times 773)^{2}$

D. $1.44 \times 10^{-5} / (0.082 \times 773)^{-2}$

Answer: D

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12. At constant temperature, the equilibrium constant (K_p) for the decomposition reaction, $N_2O_4 \Leftrightarrow 2NO$ is expressed by $K_p = \frac{(4x^2P)}{(1-x^2)}$, where P = pressure, x = extent of decomposition. Which one of the following statements is true?

A. K_p increases with increase of P

B. K_p increases with increase of x

C. K_p increases with decrease of x

D. K_p remains constant with change in P and x

Answer: B

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13. An equilibrium mixture contains 0.5, 0.12 and 5 moles of SO_2, O_2 and SO_3 respectively, in a one litre vessel at a certain temperature. How many mole of O_2 must be forced into the reaction mixture in order to increase the conc. Of SO_3 to 5.3 mole at the same temperature? (Given K_c for the reaction, $2SO_2 + O_2 \Leftrightarrow 2SO_3$ is 800)

A. 0.506

B. 0.908

C. 0.74

D. 0.45

Answer: B

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14. Vapour density of PCl_5 is 104.16 but when heated at $230^\circ C$ its vapour density is reduced to 62. The degree of dissociation of PCl_5 at this temperature will be

A. $6.8\,\%$

B. $68\,\%$

C. $46\ \%$

D. $64\ \%$

Answer: B

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15. At a certain temperature and a total pressure of 10^5 Pa, iodine vapours contain 40% by volume of iodine atoms $\left[I_{2(g)} \Leftrightarrow 2I_{(g)}\right]$.

K_p for the equilibrium will be

A. 0.67

B. 1.5

C. 2.67×10^4

D. 9.0×10^4

Answer: C

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Wb Jee Workout Category 3 One Or More Than One Option Correct Type

1. The equilibrium constant of the following reaction in equilibrium at $27^\circ C$,

$A + B \Leftrightarrow C + D$ is 10.

Which of the following statements for the given reaction is/are correct?

A. Free energy change of the reaction is zero

B. Standard free energy of the reaction is zero

C. Standard free energy of the reaction is $-5.74kJ$

D. Free energy change when all the reactants and products are 1 molal each will be $-5.74kJ$

Answer: A::C::D

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2. For which of the following reactions, $K_p = K_c$?

A. $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$

B. $2N_2O_{4(g)} \Leftrightarrow 4NO_{2(g)}$

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

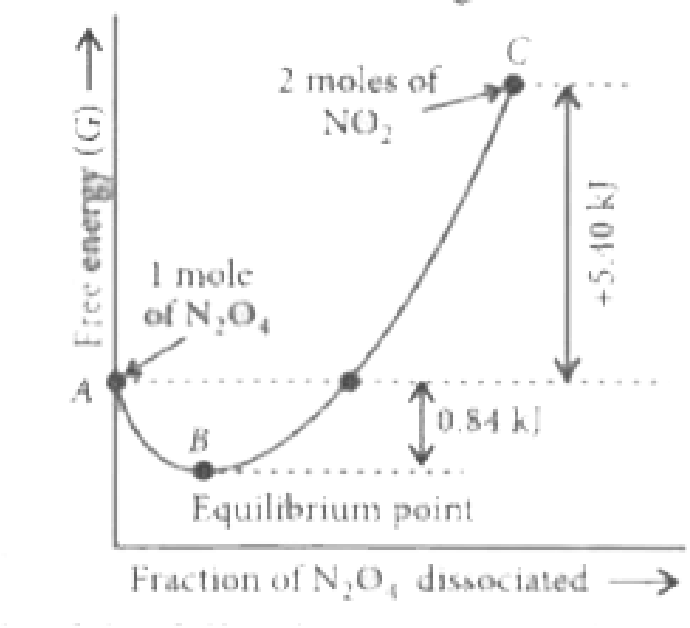
D. $H_{2(g)} + Cl_{2(g)} \Leftrightarrow 2HCl_{(g)}$

Answer: A::D

View Text Solution

3. For the dissociation equilibrium,

$N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$, the variation of free energy with the fraction of N_2O_4 dissociated under standard conditions is shown in the figure :



Which of the following statements is/are correct?

A. The free energy change for the forward reaction is negative

B. The free energy change for the backward reaction is negative

C. The net free energy change for the complete reaction is positive

D. Forward reaction is more spontaneous than backward reaction

Answer: A::B::C

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4. For the reaction, $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$, the value of K is 50 at 400 K and 1700 at 500 K. Which of the following options is/are correct?

A. The reaction is endothermic

B. The reaction is exothermic

C. If $NO_{2(g)}$ and $N_2O_{4(g)}$ are mixed at 400 K at partial pressures 20 bar and 2 bar respectively, more

$N_2O_{4(g)}$ will be formed

D. The entropy of the system remains constant

Answer: A::C

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5. The equilibrium constants of the reactions,

$N_2 + 3H_2 \Leftrightarrow 2NH_3$ and $\frac{1}{2}N_2 + \frac{3}{2}H_2 \Leftrightarrow NH_3$

are K_1 and K_2 respectively. The relationship between K_1 and K_2 is/are

A. $K_1 = K_2$

B. $K_2 = \sqrt{K_1}$

C. $K_1 = K_2^2$

D. $K_1 = \sqrt{K_2}$

Answer: B::C

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6. In the presence of a catalyst, what happens to the chemical equilibrium?

A. Energy of activation of the forward and backward reactions is lowered by same amount

B. Equilibrium amount is not disturbed

C. Rates of forward and reverse reactions increase by the same factor

D. More product is forward

Answer: A::B::C

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7. 138 g of $N_2O_{4(g)}$ is placed in 8.2 L container at 300 K. The equilibrium vapour density of mixture was found to be 30.67. The (R = 0.082 L atm $mol^{-1}K^{-1}$)

A. the total pressure at equilibrium = 4.5 atm

B. the degree of dissociation of $N_2O_5 = 0.25$

C. the total number of moles at equilibrium is 1.5

D. K_p of $N_2O_4 \Leftrightarrow 2NO_{2(g)}$ will be 6 atm

Answer: A::C::D

View Text Solution

8. In which of the following reactions, the value of K_p will be equal to K_c?

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

C. $H_{2(g)} + Br_{2(g)} \Leftrightarrow 2HBr_{(g)}$

D. $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

Answer: A::C

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9. Le-Chatelier's principle is

A. if a system in equilibrium is subjected to a change of concentration, pressure or temperature, the equilibrium shifts in the direction that tends to undo the effect of change

B. applicable to all type of dynamic equilibrium

C. applicable to irreversible system

D. applicable to all physical and chemical equilibrium

Answer: A::B::D

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10. In which of the following reactions would the yield of the products be increased by the application of high pressure?

A. $2SO_2 + O_2 \Leftrightarrow 2SO_3$

B. $N_2 + 3H_2 \Leftrightarrow 2NH_3$

C. $PCl_5 \Leftrightarrow PCl_3 + Cl_2$

D. $H_2 + I_2 \Leftrightarrow 2HI$

Answer: A::B

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Wb Jee Previous Years Questions Category 1 Single Option Correct Type

1. For the reaction $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ at 300 K, the value of ΔG° is $-690.9R$. The equilibrium constant

value for the reaction at that temperature is (R is gas constant)

A. $10atm^{-1}$

B. 10 atm

C. 10

D. 1

Answer: A

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2. Equilibrium constant for the following reactions at 1200 K are given :

$2H_2O_{(g)} \Leftrightarrow 2H_{2(g)} + O_{2(g)}, K_1 = 6.4 \times 10^{-8}$

$2CO_{2(g)} \Leftrightarrow 2CO_{(g)} + O_{2(g)}, K_2 = 1.6 \times 10^{-6}$

The equilibrium constant for the reaction

$H_{2(g)} + CO_{2(g)} \Leftrightarrow CO_{(g)} + H_2O_{(g)}$ at 1200 K will be

A. 0.05

B. 20

C. 0.2

D. 5.0

Answer: D

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3. The following equilibrium constants are given :

$N_2 + 3H_2 \Leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \Leftrightarrow 2NO, K_2$

$H_2 + \frac{1}{2}O_2 \Leftrightarrow H_2O, K_3$

The equilibrium constant for the oxidation of 2 mol of NH_3 to give NO is

A. $K_1 . \frac{K_2}{K_3}$

B. $K_2 . \frac{K_3^3}{K_1}$

C. $K_2 . \frac{K_3^2}{K_1}$

D. $K_2^2 . \frac{K_3}{K_1}$

Answer: B

View Text Solution

4. In the equilibrium, $H_2 + I_2 \Leftrightarrow 2HI$, if at a given temperature the concentrations of the reactants are increased, the value of the equilibrium constant, K_c, will

A. increase

B. decrease

C. remain the same

D. cannot be predicted with certainty

Answer: C

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Wb Jee Previous Years Questions Category 2 Single Option Correct Type

1. The standard Gibbs free energy change (ΔG°) at $25^{\circ}C$ for the dissociation of $N_2O_{4(g)}$ to $NO_{2(g)}$ is (given, equilibrium cont. $= 0.15$, $R = 8.314 JK^{-1}mol^{-1}$)

A. 1.1 kJ

B. 4.7 kJ

C. 8.1 kJ

D. 38.2 kJ

Answer: B

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